

SEQUENCE LISTING

<110> Reindl, Andreas  
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<120> DNA sequence coding for a 1-deoxy-D-xylulose-5-phosphate synthase and overproduction thereof in plants

<130> 0817/000006/MEC

<140> US 09/762,045

<141> 2001-02-01

<150> PCT/EP99/05467

<151> 1999-07-30

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<170> PatentIn Vers. 2.0/WordPerfect 6.0

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| Gly Leu Ser Thr Asp Ser Cys Lys Ser Thr Ser Leu Ser Ser Ser Arg |     |
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| tct ttg gtt aca gat ctt cca tca cca tgt ctg aaa ccc aac aac aat | 144 |
| Ser Leu Val Thr Asp Leu Pro Ser Pro Cys Leu Lys Pro Asn Asn Asn |     |
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| tcc cat tca aac aga aga gca aaa gtg tgt gct tca ctt gca gag aag | 192 |
| Ser His Ser Asn Arg Arg Ala Lys Val Cys Ala Ser Leu Ala Glu Lys |     |
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| ggt gaa tat tat tca aac aga cca cca act cca tta ctt gac act att | 240 |
| Gly Glu Tyr Tyr Ser Asn Arg Pro Pro Thr Pro Leu Leu Asp Thr Ile |     |
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| aac tac cca atc cac atg aaa aat ctt tct gtc aag gaa ctg aaa caa | 288 |
| Asn Tyr Pro Ile His Met Lys Asn Leu Ser Val Lys Glu Leu Lys Gln |     |
| 85 90 95  |     |

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| ctt tct gat gag ctg aga tca gac gtg atc ttt aat gtg tcg aaa acc | 336  |
| Leu Ser Asp Glu Leu Arg Ser Asp Val Ile Phe Asn Val Ser Lys Thr |      |
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| ggt gga cat ttg ggg tca agt ctt ggt gtt gtg gag ctt act gtg gct | 384  |
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| ctt cat tac att ttc aat act cca caa gac aag att ctt tgg gat gtt | 432  |
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| gga gag agt gaa cat gat tgc ttt ggt act gga cac agc tca acc aca | 576  |
| Gly Glu Ser Glu His Asp Cys Phe Gly Thr Gly His Ser Ser Thr Thr |      |
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| ata tct gct ggt tta gga atg gcg gta gga agg gat ttg aag ggg aag | 624  |
| Ile Ser Ala Gly Leu Gly Met Ala Val Gly Arg Asp Leu Lys Gly Lys |      |
| 195 200 205   |      |
| aac aac aat gtg gtt gct gtg att ggt gat ggt gcg atg acg gca gga | 672  |
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| cag gct tat gaa gcc atg aac aac gcc gga tat cta gac tct gat atg | 720  |
| Gln Ala Tyr Glu Ala Met Asn Asn Ala Gly Tyr Leu Asp Ser Asp Met |      |
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| cct tac gcg gag aga gct gat gac aaa tac cat ggt gtt gtg aaa ttt | 1152 |
| Pro Tyr Ala Glu Arg Ala Asp Asp Lys Tyr His Gly Val Val Lys Phe |      |
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| Asp Pro Ala Thr Gly Arg Gln Phe Lys Thr Thr Asn Glu Thr Gln Ser |      |
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| Lys Asp Val Val Ala Ile His Ala Ala Met Gly Gly Gly Thr Gly Leu |      |
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| aat ctc ttt caa cgt cgc ttc cca aca aga tgt ttc gat gta gga ata | 1344 |
| Asn Leu Phe Gln Arg Arg Phe Pro Thr Arg Cys Phe Asp Val Gly Ile |      |
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| Leu Lys Pro Phe Cys Ala Ile Tyr Ser Ser Phe Met Gln Arg Ala Tyr |      |
| 465 470 475 480   |      |
| gac cag gtt gtc cat gat gtt gat ttg caa aaa tta ccg gtg aga ttt | 1488 |
| Asp Gln Val Val His Asp Val Asp Leu Gln Lys Leu Pro Val Arg Phe |      |
| 485 490 495   |      |
| gca atg gat aga gct gga ctc gtt gga gct gat ggt ccg aca cat tgt | 1536 |
| Ala Met Asp Arg Ala Gly Leu Val Gly Ala Asp Gly Pro Thr His Cys |      |
| 500 505 510   |      |
| gga gct ttc gat gtg aca ttt atg gct tgt ctt cct aac atg ata gtg | 1584 |
| Gly Ala Phe Asp Val Thr Phe Met Ala Cys Leu Pro Asn Met Ile Val |      |
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| atg gct cca tca gat gaa gca gat ctc ttt aac atg gtt gca act gct | 1632 |
| Met Ala Pro Ser Asp Glu Ala Asp Leu Phe Asn Met Val Ala Thr Ala |      |
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| gtt gcg att gat gat cgt cct tct tgt ttc cgt tac cct aga ggt aac | 1680 |
| Val Ala Ile Asp Asp Arg Pro Ser Cys Phe Arg Tyr Pro Arg Gly Asn |      |
| 545 550 555 560   |      |
| ggg att gga gtt gca tta cct ccc gga aac aaa ggt gtt cca att gag | 1728 |
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| Ile Gly Lys Gly Arg Ile Leu Lys Glu Gly Glu Arg Val Ala Leu Leu         |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| 580 585 590   |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| ggt tat ggc tca gca gtt cag agc tgt tta gga gcg gct gta atg ctc         | 1824 |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| Gly Tyr Gly Ser Ala Val Gln Ser Cys Leu Gly Ala Ala Val Met Leu         |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| 595 600 605   |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| gaa gaa cgc gga tta aac gta act gta gcg gat gca cgg ttt tgc aag         | 1872 |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| Glu Glu Arg Gly Leu Asn Val Thr Val Ala Asp Ala Arg Phe Cys Lys         |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| 610 615 620   |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| cca ttg gac cgt gct ctc att cgc agc tta gct aag tgc cac gag gtt         | 1920 |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| Pro Leu Asp Arg Ala Leu Ile Arg Ser Leu Ala Lys Ser His Glu Val         |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| 625 630 635 640   |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| ctg atc acg gtt gaa gaa ggt tcc att gga ggt ttt ggc tgc cac gtt         | 1968 |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| Leu Ile Thr Val Glu Glu Gly Ser Ile Gly Gly Phe Gly Ser His Val         |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| 645 650 655   |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| gtt cag ttt ctt gct ctc gat ggt ctt ctt gat ggc aaa ctc aag tgg         | 2016 |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| Val Gln Phe Leu Ala Leu Asp Gly Leu Leu Asp Gly Lys Leu Lys Trp         |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| 660 665 670   |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| aga cca atg gta ctg cct gat cga tac att gat cac ggt gca cca gct         | 2064 |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| Arg Pro Met Val Leu Pro Asp Arg Tyr Ile Asp His Gly Ala Pro Ala         |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| 675 680 685   |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| gat caa cta gct gaa gct gga ctc atg cca tct cac atc gca gca acc         | 2112 |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| Asp Gln Leu Ala Glu Ala Gly Leu Met Pro Ser His Ile Ala Ala Thr         |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| 690 695 700   |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| gca ctt aac tta atc ggt gca cca agg gaa gct ctg ttt tga                 | 2154 |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| Ala Leu Asn Leu Ile Gly Ala Pro Arg Glu Ala Leu Phe                     |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| 705 710 715   |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| gagtaagaat ctgttggtta aaacatatgt atacaaacac tctaaatgca acccaagggtt 2214 |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| tcttctaagt actgatcaga attcccgccc gagaagtcct ttggcaacag ctatatatat 2274  |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| ttactaagat tgtgaagaga aaggcaaagg caaagggttgt gcaaagatta gtattataga 2334 |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| taaaactggt atttgttttg taatttttagg attgtgatga gatcgtgttg taccaataac 2394 |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
| taacatcttg taaaatcaat tactctcttg tgatcttcaa taagcttgag tgacaaaaaa 2454  |      |  |  |  |     |  |  |  |  |     |  |  |  |  |  |
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| Met<br>1   | Ala        | Ser        | Ser        | Ala<br>5   | Phe        | Ala       | Phe        | Pro        | Ser<br>10  | Tyr        | Ile        | Ile        | Thr        | Lys<br>15  | Gly        |
| Gly        | Leu        | Ser        | Thr<br>20  | Asp        | Ser        | Cys       | Lys        | Ser<br>25  | Thr        | Ser        | Leu        | Ser        | Ser<br>30  | Ser        | Arg        |
| Ser        | Leu        | Val<br>35  | Thr        | Asp        | Leu        | Pro       | Ser<br>40  | Pro        | Cys        | Leu        | Lys        | Pro<br>45  | Asn        | Asn        | Asn        |
| Ser        | His<br>50  | Ser        | Asn        | Arg        | Arg        | Ala<br>55 | Lys        | Val        | Cys        | Ala        | Ser<br>60  | Leu        | Ala        | Glu        | Lys        |
| Gly<br>65  | Glu        | Tyr        | Tyr        | Ser        | Asn<br>70  | Arg       | Pro        | Pro        | Thr        | Pro<br>75  | Leu        | Leu        | Asp        | Thr        | Ile<br>80  |
| Asn        | Tyr        | Pro        | Ile        | His<br>85  | Met        | Lys       | Asn        | Leu        | Ser<br>90  | Val        | Lys        | Glu        | Leu        | Lys<br>95  | Gln        |
| Leu        | Ser        | Asp        | Glu<br>100 | Leu        | Arg        | Ser       | Asp        | Val<br>105 | Ile        | Phe        | Asn        | Val        | Ser<br>110 | Lys        | Thr        |
| Gly        | Gly        | His<br>115 | Leu        | Gly        | Ser        | Ser       | Leu<br>120 | Gly        | Val        | Val        | Glu        | Leu<br>125 | Thr        | Val        | Ala        |
| Leu        | His<br>130 | Tyr        | Ile        | Phe        | Asn<br>135 | Thr       | Pro        | Gln        | Asp        | Lys        | Ile<br>140 | Leu        | Trp        | Asp        | Val        |
| Gly<br>145 | His        | Gln        | Ser        | Tyr        | Pro<br>150 | His       | Lys        | Ile        | Leu        | Thr<br>155 | Gly        | Arg        | Arg        | Gly        | Lys<br>160 |
| Met        | Pro        | Thr        | Met        | Arg<br>165 | Gln        | Thr       | Asn        | Gly        | Leu<br>170 | Ser        | Gly        | Phe        | Thr        | Lys<br>175 | Arg        |
| Gly        | Glu        | Ser        | Glu<br>180 | His        | Asp        | Cys       | Phe        | Gly<br>185 | Thr        | Gly        | His        | Ser        | Ser<br>190 | Thr        | Thr        |
| Ile        | Ser        | Ala<br>195 | Gly        | Leu        | Gly        | Met       | Ala<br>200 | Val        | Gly        | Arg        | Asp        | Leu<br>205 | Lys        | Gly        | Lys        |
| Asn<br>210 | Asn        | Asn        | Val        | Val        | Ala<br>215 | Val       | Ile        | Gly        | Asp        | Gly        | Ala<br>220 | Met        | Thr        | Ala        | Gly        |
| Gln<br>225 | Ala        | Tyr        | Glu        | Ala        | Met<br>230 | Asn       | Asn        | Ala        | Gly        | Tyr<br>235 | Leu        | Asp        | Ser        | Asp        | Met<br>240 |
| Ile        | Val        | Ile        | Leu        | Asn<br>245 | Asp        | Asn       | Lys        | Gln        | Val<br>250 | Ser        | Leu        | Pro        | Thr        | Ala<br>255 | Thr        |
| Leu        | Asp        | Gly        | Pro<br>260 | Ser        | Pro        | Pro       | Val        | Gly<br>265 | Ala        | Leu        | Ser        | Ser        | Ala<br>270 | Leu        | Ser        |
| Arg        | Leu        | Gln<br>275 | Ser        | Asn        | Pro        | Ala       | Leu<br>280 | Arg        | Glu        | Leu        | Arg        | Glu<br>285 | Val        | Ala        | Lys        |
| Gly<br>290 | Met        | Thr        | Lys        | Gln        | Ile<br>295 | Gly       | Gly        | Pro        | Met        | His<br>300 | Gln        | Leu        | Ala        | Ala        | Lys        |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Val | Asp | Val | Tyr | Ala | Arg | Gly | Met | Ile | Ser | Gly | Thr | Gly | Ser | Ser | Leu | 305 | 310 | 315 | 320 |
| Phe | Glu | Glu | Leu | Gly | Leu | Tyr | Tyr | Ile | Gly | Pro | Val | Asp | Gly | His | Asn | 325 | 330 | 335 |     |
| Ile | Asp | Asp | Leu | Val | Ala | Ile | Leu | Lys | Glu | Val | Lys | Ser | Thr | Arg | Thr | 340 | 345 | 350 |     |
| Thr | Gly | Pro | Val | Leu | Ile | His | Val | Val | Thr | Glu | Lys | Gly | Arg | Gly | Tyr | 355 | 360 | 365 |     |
| Pro | Tyr | Ala | Glu | Arg | Ala | Asp | Asp | Lys | Tyr | His | Gly | Val | Val | Lys | Phe | 370 | 375 | 380 |     |
| Asp | Pro | Ala | Thr | Gly | Arg | Gln | Phe | Lys | Thr | Thr | Asn | Glu | Thr | Gln | Ser | 385 | 390 | 395 | 400 |
| Tyr | Thr | Thr | Tyr | Phe | Ala | Glu | Ala | Leu | Val | Ala | Glu | Ala | Glu | Val | Asp | 405 | 410 | 415 |     |
| Lys | Asp | Val | Val | Ala | Ile | His | Ala | Ala | Met | Gly | Gly | Gly | Thr | Gly | Leu | 420 | 425 | 430 |     |
| Asn | Leu | Phe | Gln | Arg | Arg | Phe | Pro | Thr | Arg | Cys | Phe | Asp | Val | Gly | Ile | 435 | 440 | 445 |     |
| Ala | Glu | Gln | His | Ala | Val | Thr | Phe | Ala | Ala | Gly | Leu | Ala | Cys | Glu | Gly | 450 | 455 | 460 |     |
| Leu | Lys | Pro | Phe | Cys | Ala | Ile | Tyr | Ser | Ser | Phe | Met | Gln | Arg | Ala | Tyr | 465 | 470 | 475 | 480 |
| Asp | Gln | Val | Val | His | Asp | Val | Asp | Leu | Gln | Lys | Leu | Pro | Val | Arg | Phe | 485 | 490 | 495 |     |
| Ala | Met | Asp | Arg | Ala | Gly | Leu | Val | Gly | Ala | Asp | Gly | Pro | Thr | His | Cys | 500 | 505 | 510 |     |
| Gly | Ala | Phe | Asp | Val | Thr | Phe | Met | Ala | Cys | Leu | Pro | Asn | Met | Ile | Val | 515 | 520 | 525 |     |
| Met | Ala | Pro | Ser | Asp | Glu | Ala | Asp | Leu | Phe | Asn | Met | Val | Ala | Thr | Ala | 530 | 535 | 540 |     |
| Val | Ala | Ile | Asp | Asp | Arg | Pro | Ser | Cys | Phe | Arg | Tyr | Pro | Arg | Gly | Asn | 545 | 550 | 555 | 560 |
| Gly | Ile | Gly | Val | Ala | Leu | Pro | Pro | Gly | Asn | Lys | Gly | Val | Pro | Ile | Glu | 565 | 570 | 575 |     |
| Ile | Gly | Lys | Gly | Arg | Ile | Leu | Lys | Glu | Gly | Glu | Arg | Val | Ala | Leu | Leu | 580 | 585 | 590 |     |
| Gly | Tyr | Gly | Ser | Ala | Val | Gln | Ser | Cys | Leu | Gly | Ala | Ala | Val | Met | Leu | 595 | 600 | 605 |     |
| Glu | Glu | Arg | Gly | Leu | Asn | Val | Thr | Val | Ala | Asp | Ala | Arg | Phe | Cys | Lys | 610 | 615 | 620 |     |

Pro Leu Asp Arg Ala Leu Ile Arg Ser Leu Ala Lys Ser His Glu Val  
625 630 635 640

Leu Ile Thr Val Glu Gly Ser Ile Gly Gly Phe Gly Ser His Val  
645 650 655

Val Gln Phe Leu Ala Leu Asp Gly Leu Leu Asp Gly Lys Leu Lys Trp  
660 665 670

Arg Pro Met Val Leu Pro Asp Arg Tyr Ile Asp His Gly Ala Pro Ala  
675 680 685

Asp Gln Leu Ala Glu Ala Gly Leu Met Pro Ser His Ile Ala Ala Thr  
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Ala Leu Asn Leu Ile Gly Ala Pro Arg Glu Ala Leu Phe  
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acc cag gag tta cga ctg ttg ccg aaa gag agt tta ccg aaa ctc tgc 96  
Thr Gln Glu Leu Arg Leu Leu Pro Lys Glu Ser Leu Pro Lys Leu Cys  
20 25 30

gac gaa ctg cgc cgc tat tta ctc gac agc gtg agc cgt tcc agc ggg 144  
Asp Glu Leu Arg Arg Tyr Leu Leu Asp Ser Val Ser Arg Ser Ser Gly  
35 40 45

cac ttc gcc tcc ggg ctg ggc acg gtc gaa ctg acc gtg gcg ctg cac 192  
His Phe Ala Ser Gly Leu Gly Thr Val Glu Leu Thr Val Ala Leu His  
50 55 60

tat gtc tac aac acc ccg ttt gac caa ttg att tgg gat gtg ggg cat 240  
Tyr Val Tyr Asn Thr Pro Phe Asp Gln Leu Ile Trp Asp Val Gly His  
65 70 75 80

cag gct tat ccg cat aaa att ttg acc gga cgc cgc gac aaa atc ggc 288  
Gln Ala Tyr Pro His Lys Ile Leu Thr Gly Arg Arg Asp Lys Ile Gly  
85 90 95

acc atc cgt cag aaa ggc ggt ctg cac ccg ttc ccg tgg cgc ggc gaa 336  
Thr Ile Arg Gln Lys Gly Gly Leu His Pro Phe Pro Trp Arg Gly Glu  
100 105 110

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|---|------|
| agc gaa tat gac gta tta agc gtc ggg cat tca tca acc tcc atc agt | 384  |
| Ser Glu Tyr Asp Val Leu Ser Val Gly His Ser Ser Thr Ser Ile Ser |      |
| 115 120 125   |      |
| gcc gga att ggt att gcg gtt gct gcc gaa aaa gaa ggc aaa aat cgc | 432  |
| Ala Gly Ile Gly Ile Ala Val Ala Ala Glu Lys Glu Gly Lys Asn Arg |      |
| 130 135 140   |      |
| cgc acc gtc tgt gtc att ggc gat ggc gcg att acc gca ggc atg gcg | 480  |
| Arg Thr Val Cys Val Ile Gly Asp Gly Ala Ile Thr Ala Gly Met Ala |      |
| 145 150 155 160   |      |
| ttt gaa gcg atg aat cac gcg ggc gat atc cgt cct gat atg ctg gtg | 528  |
| Phe Glu Ala Met Asn His Ala Gly Asp Ile Arg Pro Asp Met Leu Val |      |
| 165 170 175   |      |
| att ctc aac gac aat gaa atg tgc att tcc gaa aat gtc ggc gcg ctc | 576  |
| Ile Leu Asn Asp Asn Glu Met Ser Ile Ser Glu Asn Val Gly Ala Leu |      |
| 180 185 190   |      |
| aac aac cat ctg gca cag ctg ctt tcc ggt aag ctt tac tct tca ctg | 624  |
| Asn Asn His Leu Ala Gln Leu Leu Ser Gly Lys Leu Tyr Ser Ser Leu |      |
| 195 200 205   |      |
| cgc gaa ggc ggg aaa aaa gtt ttc tct ggc gtg ccg cca att aaa gag | 672  |
| Arg Glu Gly Gly Lys Lys Val Phe Ser Gly Val Pro Pro Ile Lys Glu |      |
| 210 215 220   |      |
| ctg ctc aaa cgc acc gaa gaa cat att aaa ggc atg gta gtg cct ggc | 720  |
| Leu Leu Lys Arg Thr Glu Glu His Ile Lys Gly Met Val Val Pro Gly |      |
| 225 230 235 240   |      |
| acg ttg ttt gaa gag ctg ggc ttt aac tac atc ggc ccg gtg gac ggt | 768  |
| Thr Leu Phe Glu Glu Leu Gly Phe Asn Tyr Ile Gly Pro Val Asp Gly |      |
| 245 250 255   |      |
| cac gat gtg ctg ggg ctt atc acc acg cta aag aac atg cgc gac ctg | 816  |
| His Asp Val Leu Gly Leu Ile Thr Thr Leu Lys Asn Met Arg Asp Leu |      |
| 260 265 270   |      |
| aaa ggc ccg cag ttc ctg cat atc atg acc aaa aaa ggt cgt ggt tat | 864  |
| Lys Gly Pro Gln Phe Leu His Ile Met Thr Lys Lys Gly Arg Gly Tyr |      |
| 275 280 285   |      |
| gaa ccg gca gaa aaa gac ccg atc act ttc cac gcc gtg cct aaa ttt | 912  |
| Glu Pro Ala Glu Lys Asp Pro Ile Thr Phe His Ala Val Pro Lys Phe |      |
| 290 295 300   |      |
| gat ccc tcc agc ggt tgt ttg ccg aaa agt agc ggc ggt ttg ccg agc | 960  |
| Asp Pro Ser Ser Gly Cys Leu Pro Lys Ser Ser Gly Gly Leu Pro Ser |      |
| 305 310 315 320   |      |
| tat tca aaa atc ttt ggc gac tgg ttg tgc gaa acg gca gcg aaa gac | 1008 |
| Tyr Ser Lys Ile Phe Gly Asp Trp Leu Cys Glu Thr Ala Ala Lys Asp |      |
| 325 330 335   |      |
| aac aag ctg atg gcg att act ccg gcg atg cgt gaa ggt tcc ggc atg | 1056 |
| Asn Lys Leu Met Ala Ile Thr Pro Ala Met Arg Glu Gly Ser Gly Met |      |
| 340 345 350   |      |



|   |      |
|---|------|
| gtc gag ttt tca cgt aaa ttc ccg gat cgc tac ttc gac gtg gca att | 1104 |
| Val Glu Phe Ser Arg Lys Phe Pro Asp Arg Tyr Phe Asp Val Ala Ile |      |
| 355 360 365   |      |
| gcc gag caa cac gcg gtg acc ttt gct gcg ggt ctg gcg att ggt ggg | 1152 |
| Ala Glu Gln His Ala Val Thr Phe Ala Ala Gly Leu Ala Ile Gly Gly |      |
| 370 375 380   |      |
| tac aaa ccc att gtc gcg att tac tcc act ttc ctg caa cgc gcc tat | 1200 |
| Tyr Lys Pro Ile Val Ala Ile Tyr Ser Thr Phe Leu Gln Arg Ala Tyr |      |
| 385 390 395 400   |      |
| gat cag gtg ctg cat gac gtg gcg att caa aag ctt ccg gtc ctg ttc | 1248 |
| Asp Gln Val Leu His Asp Val Ala Ile Gln Lys Leu Pro Val Leu Phe |      |
| 405 410 415   |      |
| gcc atc gac cgc gcg ggc att gtt ggt gct gac ggt caa acc cat cag | 1296 |
| Ala Ile Asp Arg Ala Gly Ile Val Gly Ala Asp Gly Gln Thr His Gln |      |
| 420 425 430   |      |
| ggg gct ttt gat ctc tct tac ctg cgc tgc ata ccg gaa atg gtc att | 1344 |
| Gly Ala Phe Asp Leu Ser Tyr Leu Arg Cys Ile Pro Glu Met Val Ile |      |
| 435 440 445   |      |
| atg acc ccg agc gat gaa aac gaa tgt cgc cag atg ctc tat acc ggc | 1392 |
| Met Thr Pro Ser Asp Glu Asn Glu Cys Arg Gln Met Leu Tyr Thr Gly |      |
| 450 455 460   |      |
| tat cac tat aac gat ggc ccg tca gcg gtg cgc tac ccg cgt ggc aac | 1440 |
| Tyr His Tyr Asn Asp Gly Pro Ser Ala Val Arg Tyr Pro Arg Gly Asn |      |
| 465 470 475 480   |      |
| gcg gtc ggc gtg gaa ctg acg ccg ctg gaa aaa cta cca att ggc aaa | 1488 |
| Ala Val Gly Val Glu Leu Thr Pro Leu Glu Lys Leu Pro Ile Gly Lys |      |
| 485 490 495   |      |
| ggc att gtg aag cgt cgt ggc gag aaa ctg gcg atc ctt aac ttt ggt | 1536 |
| Gly Ile Val Lys Arg Arg Gly Glu Lys Leu Ala Ile Leu Asn Phe Gly |      |
| 500 505 510   |      |
| acg ctg atg cca gaa gcg gcg aaa gtc gcc gaa tcg ctg aac gcc acg | 1584 |
| Thr Leu Met Pro Glu Ala Ala Lys Val Ala Glu Ser Leu Asn Ala Thr |      |
| 515 520 525   |      |
| ctg gtc gat atg cgt ttt gtg aaa ccg ctt gat gaa gcg tta att ctg | 1632 |
| Leu Val Asp Met Arg Phe Val Lys Pro Leu Asp Glu Ala Leu Ile Leu |      |
| 530 535 540   |      |
| gaa atg gcc gcc agc cat gaa gcg ctg gtc acc gta gaa gaa aac gcc | 1680 |
| Glu Met Ala Ala Ser His Glu Ala Leu Val Thr Val Glu Glu Asn Ala |      |
| 545 550 555 560   |      |
| att atg ggc ggc gca ggc agc ggc gtg aac gaa gtg ctg atg gcc cat | 1728 |
| Ile Met Gly Gly Ala Gly Ser Gly Val Asn Glu Val Leu Met Ala His |      |
| 565 570 575   |      |
| cgt aaa cca gta ccc gtg ctg aac att ggc ctg ccg gac ttc ttt att | 1776 |
| Arg Lys Pro Val Pro Val Leu Asn Ile Gly Leu Pro Asp Phe Phe Ile |      |

| 580 |     |     |     |     | 585 |     |     |     |     | 590 |     |     |     |     |     |      |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| ccg | caa | gga | act | cag | gaa | gaa | atg | cgc | gcc | gaa | ctc | ggc | ctc | gat | gcc | 1824 |
| Pro | Gln | Gly | Thr | Gln | Glu | Glu | Met | Arg | Ala | Glu | Leu | Gly | Leu | Asp | Ala |      |
|     |     | 595 |     |     |     |     | 600 |     |     |     |     | 605 |     |     |     |      |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |
| gct | ggt | atg | gaa | gcc | aaa | atc | aag | gcc | tgg | ctg | gca | taa |     |     |     | 1863 |
| Ala | Gly | Met | Glu | Ala | Lys | Ile | Lys | Ala | Trp | Leu | Ala |     |     |     |     |      |
|     | 610 |     |     |     |     | 615 |     |     |     |     | 620 |     |     |     |     |      |

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 <212> PRT  
 <213> Escherichia coli

<400> 4

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Met | Ser | Phe | Asp | Ile | Ala | Lys | Tyr | Pro | Thr | Leu | Ala | Leu | Val | Asp | Ser |  |
| 1   |     |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |  |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Thr | Gln | Glu | Leu | Arg | Leu | Leu | Pro | Lys | Glu | Ser | Leu | Pro | Lys | Leu | Cys |  |
|     |     | 20  |     |     |     |     | 25  |     |     |     |     |     | 30  |     |     |  |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Asp | Glu | Leu | Arg | Arg | Tyr | Leu | Leu | Asp | Ser | Val | Ser | Arg | Ser | Ser | Gly |  |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |  |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| His | Phe | Ala | Ser | Gly | Leu | Gly | Thr | Val | Glu | Leu | Thr | Val | Ala | Leu | His |  |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |  |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Tyr | Val | Tyr | Asn | Thr | Pro | Phe | Asp | Gln | Leu | Ile | Trp | Asp | Val | Gly | His |  |
| 65  |     |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |  |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Gln | Ala | Tyr | Pro | His | Lys | Ile | Leu | Thr | Gly | Arg | Arg | Asp | Lys | Ile | Gly |  |
|     |     |     |     | 85  |     |     |     |     | 90  |     |     |     |     | 95  |     |  |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Thr | Ile | Arg | Gln | Lys | Gly | Gly | Leu | His | Pro | Phe | Pro | Trp | Arg | Gly | Glu |  |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |  |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Ser | Glu | Tyr | Asp | Val | Leu | Ser | Val | Gly | His | Ser | Ser | Thr | Ser | Ile | Ser |  |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |  |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Ala | Gly | Ile | Gly | Ile | Ala | Val | Ala | Ala | Glu | Lys | Glu | Gly | Lys | Asn | Arg |  |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Arg | Thr | Val | Cys | Val | Ile | Gly | Asp | Gly | Ala | Ile | Thr | Ala | Gly | Met | Ala |  |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Phe | Glu | Ala | Met | Asn | His | Ala | Gly | Asp | Ile | Arg | Pro | Asp | Met | Leu | Val |  |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |  |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Ile | Leu | Asn | Asp | Asn | Glu | Met | Ser | Ile | Ser | Glu | Asn | Val | Gly | Ala | Leu |  |
|     |     | 180 |     |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Asn | Asn | His | Leu | Ala | Gln | Leu | Leu | Ser | Gly | Lys | Leu | Tyr | Ser | Ser | Leu |  |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| Arg | Glu | Gly | Gly | Lys | Lys | Val | Phe | Ser | Gly | Val | Pro | Pro | Ile | Lys | Glu |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |

Leu Leu Lys Arg Thr Glu Glu His Ile Lys Gly Met Val Val Pro Gly  
 225 230 235 240  
 Thr Leu Phe Glu Glu Leu Gly Phe Asn Tyr Ile Gly Pro Val Asp Gly  
 245 250 255  
 His Asp Val Leu Gly Leu Ile Thr Thr Leu Lys Asn Met Arg Asp Leu  
 260 265 270  
 Lys Gly Pro Gln Phe Leu His Ile Met Thr Lys Lys Gly Arg Gly Tyr  
 275 280 285  
 Glu Pro Ala Glu Lys Asp Pro Ile Thr Phe His Ala Val Pro Lys Phe  
 290 295 300  
 Asp Pro Ser Ser Gly Cys Leu Pro Lys Ser Ser Gly Gly Leu Pro Ser  
 305 310 315 320  
 Tyr Ser Lys Ile Phe Gly Asp Trp Leu Cys Glu Thr Ala Ala Lys Asp  
 325 330 335  
 Asn Lys Leu Met Ala Ile Thr Pro Ala Met Arg Glu Gly Ser Gly Met  
 340 345 350  
 Val Glu Phe Ser Arg Lys Phe Pro Asp Arg Tyr Phe Asp Val Ala Ile  
 355 360 365  
 Ala Glu Gln His Ala Val Thr Phe Ala Ala Gly Leu Ala Ile Gly Gly  
 370 375 380  
 Tyr Lys Pro Ile Val Ala Ile Tyr Ser Thr Phe Leu Gln Arg Ala Tyr  
 385 390 395 400  
 Asp Gln Val Leu His Asp Val Ala Ile Gln Lys Leu Pro Val Leu Phe  
 405 410 415  
 Ala Ile Asp Arg Ala Gly Ile Val Gly Ala Asp Gly Gln Thr His Gln  
 420 425 430  
 Gly Ala Phe Asp Leu Ser Tyr Leu Arg Cys Ile Pro Glu Met Val Ile  
 435 440 445  
 Met Thr Pro Ser Asp Glu Asn Glu Cys Arg Gln Met Leu Tyr Thr Gly  
 450 455 460  
 Tyr His Tyr Asn Asp Gly Pro Ser Ala Val Arg Tyr Pro Arg Gly Asn  
 465 470 475 480  
 Ala Val Gly Val Glu Leu Thr Pro Leu Glu Lys Leu Pro Ile Gly Lys  
 485 490 495  
 Gly Ile Val Lys Arg Arg Gly Glu Lys Leu Ala Ile Leu Asn Phe Gly  
 500 505 510  
 Thr Leu Met Pro Glu Ala Ala Lys Val Ala Glu Ser Leu Asn Ala Thr  
 515 520 525  
 Leu Val Asp Met Arg Phe Val Lys Pro Leu Asp Glu Ala Leu Ile Leu

|   |                             |                     |     |     |
|---|-----------------------------|---------------------|-----|-----|
| 530   |                             | 535                 |     | 540 |
| Glu Met Ala Ala Ser His   | Glu Ala Leu Val Thr         | Val Glu Glu Asn Ala |     |     |
| 545   | 550                         | 555                 | 560 |     |
| Ile Met Gly Gly Ala Gly Ser Gly Val                             | Asn Glu Val Leu Met Ala His |                     |     |     |
|   | 565                         | 570                 | 575 |     |
| Arg Lys Pro Val Pro Val Leu Asn Ile Gly Leu Pro Asp Phe Phe Ile |                             |                     |     |     |
|   | 580                         | 585                 | 590 |     |
| Pro Gln Gly Thr Gln Glu Glu Met Arg Ala Glu Leu Gly Leu Asp Ala |                             |                     |     |     |
|   | 595                         | 600                 | 605 |     |
| Ala Gly Met Glu Ala Lys Ile Lys Ala Trp Leu Ala                 |                             |                     |     |     |
| 610   | 615                         | 620                 |     |     |

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| aagccgggtcg agccgcgcct gcacggtgcc gcgcgcgacc ccgagccgcc gggacatctc | 120                     |
| gagcactccg atgcgcggct cccgcgccag cagcaccagg agccggccgt ccagatgac   | 180                     |
| gatcgccacg gcagcccctc cagtgggtcat cctgtac atg cag ccc cac gcc atg  | 235                     |
|  | Met Gln Pro His Ala Met |
|  | 1 5                     |
| ggc ggt gca ctg aac aca ttg tcc agc gga caa gcc aac tat tgc gca    | 283                     |
| Gly Gly Ala Leu Asn Thr Leu Ser Ser Gly Gln Ala Asn Tyr Cys Ala    |                         |
|  | 10 15 20                |
| cct tgc gga acg gag cga ccc tgc cgc cat gac gca gac cac aca cca    | 331                     |
| Pro Cys Gly Thr Glu Arg Pro Cys Arg His Asp Ala Asp His Thr Pro    |                         |
|  | 25 30 35                |
| cac tcc cga cac cgc ccg gca ggc cga ccc ctt ccc ggt gaa ggg aat    | 379                     |
| His Ser Arg His Arg Pro Ala Gly Arg Pro Leu Pro Gly Glu Gly Asn    |                         |
|  | 40 45 50                |
| gga cgc ggt cgt ctt cgc cgt agg caa cgc caa gca ggc cgc gca cta    | 427                     |
| Gly Arg Gly Arg Leu Arg Arg Arg Gln Arg Gln Ala Gly Arg Ala Leu    |                         |
|  | 55 60 65 70             |
| ctc cac cgc ctt cgg cat gca gct tgt ggc gta ctc cgg acc gga gaa    | 475                     |
| Leu His Arg Leu Arg His Ala Ala Cys Gly Val Leu Arg Thr Gly Glu    |                         |
|  | 75 80 85                |

|   |      |
|---|------|
| cgg cag ccg cga gac cgc ttc gta cgt cct cac caa cgg ctc ggc acg   | 523  |
| Arg Gln Pro Arg Asp Arg Phe Val Arg Pro His Gln Arg Leu Gly Thr   |      |
| 90 95 100   |      |
| ctt cgt cct cac ctc cgt cat caa gcc cgc cac ccc ctg ggg cca ctt   | 571  |
| Leu Arg Pro His Leu Arg His Gln Ala Arg His Pro Leu Gly Pro Leu   |      |
| 105 110 115   |      |
| cct cgc cga cca tgt ggc cga gca cgg cga cgg cgt cgt cga cct cgc   | 619  |
| Pro Arg Arg Pro Cys Gly Arg Ala Arg Arg Arg Arg Arg Arg Pro Arg   |      |
| 120 125 130   |      |
| cat cga ggt ccc gga cgc ccg cgc cgc cca cgc gta cgc gat cga gca   | 667  |
| His Arg Gly Pro Gly Arg Pro Arg Arg Pro Arg Val Arg Asp Arg Ala   |      |
| 135 140 145 150   |      |
| cgg cgc ccg ctc ggt cgc cga gcc gta cga gct gaa gga cga gca cgg   | 715  |
| Arg Arg Pro Leu Gly Arg Arg Ala Val Arg Ala Glu Gly Arg Ala Arg   |      |
| 155 160 165   |      |
| cac ggt cgt cct cgc cgc gat cgc cac cta cgg caa gac ccg cca cac   | 763  |
| His Gly Arg Pro Arg Arg Asp Arg His Leu Arg Gln Asp Pro Pro His   |      |
| 170 175 180   |      |
| cct cgt cga ccg gac cgg cta cga cgg ccc cta cct ccc cgg cta cgt   | 811  |
| Pro Arg Arg Pro Asp Arg Leu Arg Arg Pro Leu Pro Pro Arg Leu Arg   |      |
| 185 190 195   |      |
| ggc cgc cgc ccc gat cgt cga acc gcc cgc cca ccg cac ctt cca ggc   | 859  |
| Gly Arg Arg Pro Asp Arg Arg Thr Ala Arg Pro Pro His Leu Pro Gly   |      |
| 200 205 210   |      |
| cat cga cca ctg cgt cgg caa cgt cga gct cgg ccg gat gaa cga atg   | 907  |
| His Arg Pro Leu Arg Arg Gln Arg Arg Ala Arg Pro Asp Glu Arg Met   |      |
| 215 220 225 230   |      |
| ggt cgg ctt cta caa caa ggt cat ggg ctt cac gaa cat gaa gga gtt   | 955  |
| Gly Arg Leu Leu Gln Gln Gly His Gly Leu His Glu His Glu Gly Val   |      |
| 235 240 245   |      |
| cgt ggg cga cga cat cgc gac cga gta ctc ggc gct gat gtc gaa ggt   | 1003 |
| Arg Gly Arg Arg His Arg Asp Arg Val Leu Gly Ala Asp Val Glu Gly   |      |
| 250 255 260   |      |
| cgt ggc cga cgg cac gct caa ggt caa gtt ccc gat caa cga gcc cgc   | 1051 |
| Arg Gly Arg Arg His Ala Gln Gly Gln Val Pro Asp Gln Arg Ala Arg   |      |
| 265 270 275   |      |
| cct cgc caa gaa gaa gtc cca gat cga cga gta cct gga gtt cta cgg   | 1099 |
| Pro Arg Gln Glu Glu Val Pro Asp Arg Arg Val Pro Gly Val Leu Arg   |      |
| 280 285 290   |      |
| cgg cgc ggg cgt cca gca cat cgc gct gaa cac ggg tga catcgtcgag    | 1148 |
| Arg Arg Gly Arg Pro Ala His Arg Ala Glu His Gly                   |      |
| 295 300 305   |      |
| acggtacgca cgatgcgcgc cgccggcgtc cagttcctgg acacgcccg ctcgtactac  | 1208 |
| gacaccctcg gggagtgggt gggcgacacc cgcgtccccg tcgacaccct gcgcgagctg | 1268 |

aagatcctcg cggaccgcga cgaggacggc tatctgctcc agatcttcac caagccgggc 1328  
 caggaccgcc cgacgggtctt cttcgagatc atcgaacgcc acggctcgat gggattcggc 1388  
 aagggaact tcaaggccct gttcgaggcg atcgagcggg agcaggagaa gcggggcaac 1448  
 ctgtaggcgg cgcggcccgg g 1469

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 <211> 306  
 <212> PRT  
 <213> Streptomyces avermitilis

<400> 6

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|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Met | Gln | Pro | His | Ala | Met | Gly | Gly | Ala | Leu | Asn | Thr | Leu | Ser | Ser | Gly | 1   | 5   | 10  | 15  |
| Gln | Ala | Asn | Tyr | Cys | Ala | Pro | Cys | Gly | Thr | Glu | Arg | Pro | Cys | Arg | His | 20  | 25  | 30  |     |
| Asp | Ala | Asp | His | Thr | Pro | His | Ser | Arg | His | Arg | Pro | Ala | Gly | Arg | Pro | 35  | 40  | 45  |     |
| Leu | Pro | Gly | Glu | Gly | Asn | Gly | Arg | Gly | Arg | Leu | Arg | Arg | Arg | Gln | Arg | 50  | 55  | 60  |     |
| Gln | Ala | Gly | Arg | Ala | Leu | Leu | His | Arg | Leu | Arg | His | Ala | Ala | Cys | Gly | 65  | 70  | 75  | 80  |
| Val | Leu | Arg | Thr | Gly | Glu | Arg | Gln | Pro | Arg | Asp | Arg | Phe | Val | Arg | Pro | 85  | 90  | 95  |     |
| His | Gln | Arg | Leu | Gly | Thr | Leu | Arg | Pro | His | Leu | Arg | His | Gln | Ala | Arg | 100 | 105 | 110 |     |
| His | Pro | Leu | Gly | Pro | Leu | Pro | Arg | Pro | Cys | Gly | Arg | Ala | Arg | Arg |     | 115 | 120 | 125 |     |
| Arg | Arg | Arg | Arg | Pro | Arg | His | Arg | Gly | Pro | Gly | Arg | Pro | Arg | Arg | Pro | 130 | 135 | 140 |     |
| Arg | Val | Arg | Asp | Arg | Ala | Arg | Arg | Pro | Leu | Gly | Arg | Arg | Ala | Val | Arg | 145 | 150 | 155 | 160 |
| Ala | Glu | Gly | Arg | Ala | Arg | His | Gly | Arg | Pro | Arg | Arg | Asp | Arg | His | Leu | 165 | 170 | 175 |     |
| Arg | Gln | Asp | Pro | Pro | His | Pro | Arg | Arg | Pro | Asp | Arg | Leu | Arg | Arg | Pro | 180 | 185 | 190 |     |
| Leu | Pro | Pro | Arg | Leu | Arg | Gly | Arg | Arg | Pro | Asp | Arg | Arg | Thr | Ala | Arg | 195 | 200 | 205 |     |
| Pro | Pro | His | Leu | Pro | Gly | His | Arg | Pro | Leu | Arg | Arg | Gln | Arg | Arg | Ala | 210 | 215 | 220 |     |

Arg Pro Asp Glu Arg Met Gly Arg Leu Leu Gln Gln Gly His Gly Leu  
 225 230 235 240  
 His Glu His Glu Gly Val Arg Gly Arg Arg His Arg Asp Arg Val Leu  
 245 250 255  
 Gly Ala Asp Val Glu Gly Arg Gly Arg Arg His Ala Gln Gly Gln Val  
 260 265 270  
 Pro Asp Gln Arg Ala Arg Pro Arg Gln Glu Glu Val Pro Asp Arg Arg  
 275 280 285  
 Val Pro Gly Val Leu Arg Arg Arg Gly Arg Pro Ala His Arg Ala Glu  
 290 295 300  
 His Gly  
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<400> 7

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| Met Ala Thr Thr Val Thr Leu Lys Ser Phe Thr Gly Leu Arg Gln Ser |     |
| 1 5 10 15   |     |
| tca acg gag caa aca aac ttc gtc tct cat gta ccg tca tca ctt tct | 96  |
| Ser Thr Glu Gln Thr Asn Phe Val Ser His Val Pro Ser Ser Leu Ser |     |
| 20 25 30  |     |
| ctc cct caa cga cgg acc tct ctc cga gta acc gca gcc agg gcc act | 144 |
| Leu Pro Gln Arg Arg Thr Ser Leu Arg Val Thr Ala Ala Arg Ala Thr |     |
| 35 40 45  |     |
| ccc aaa ctc tcc aac cgt aaa ctc cgt gtc gcc gtc atc ggt ggt gga | 192 |
| Pro Lys Leu Ser Asn Arg Lys Leu Arg Val Ala Val Ile Gly Gly Gly |     |
| 50 55 60  |     |
| cca gca ggc ggg gca gct gca gag act cta gca caa gga gga atc gag | 240 |
| Pro Ala Gly Gly Ala Ala Ala Glu Thr Leu Ala Gln Gly Gly Ile Glu |     |
| 65 70 75 80   |     |
| acg att ctc atc gag cgt aag atg gac aat tgc aag cct tgc ggt ggc | 288 |
| Thr Ile Leu Ile Glu Arg Lys Met Asp Asn Cys Lys Pro Cys Gly Gly |     |
| 85 90 95  |     |
| gcg att cct ctc tgt atg gtc gga gaa ttc aac ttg ccg ttg gat att | 336 |
| Ala Ile Pro Leu Cys Met Val Gly Glu Phe Asn Leu Pro Leu Asp Ile |     |
| 100 105 110   |     |
| att gat cgg aga gtg acg aag atg aag atg att tcg ccg tcg aac att | 384 |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|--|
| Ile | Asp | Arg | Arg | Val | Thr | Lys | Met | Lys | Met | Ile | Ser | Pro | Ser | Asn | Ile |      |  |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |      |  |
| gct | ggt | gat | att | ggg | cgt | acg | ctt | aag | gag | cat | gag | tat | ata | ggg | atg | 432  |  |
| Ala | Val | Asp | Ile | Gly | Arg | Thr | Leu | Lys | Glu | His | Glu | Tyr | Ile | Gly | Met |      |  |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |      |  |
| gtg | aga | aga | gaa | ggt | ctt | gat | gct | tat | ctg | aga | gag | aga | gct | gag | aag | 480  |  |
| Val | Arg | Arg | Glu | Val | Leu | Asp | Ala | Tyr | Leu | Arg | Glu | Arg | Ala | Glu | Lys |      |  |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |      |  |
| agt | gga | gcc | act | gtg | att | aac | ggg | ctc | ttc | ctt | aag | atg | gat | cat | ccg | 528  |  |
| Ser | Gly | Ala | Thr | Val | Ile | Asn | Gly | Leu | Phe | Leu | Lys | Met | Asp | His | Pro |      |  |
|     |     |     | 165 |     |     |     |     |     | 170 |     |     |     |     | 175 |     |      |  |
| gag | aat | tgg | gac | tgc | ccg | tac | act | ttg | cat | tac | act | gag | tac | gat | ggg | 576  |  |
| Glu | Asn | Trp | Asp | Ser | Pro | Tyr | Thr | Leu | His | Tyr | Thr | Glu | Tyr | Asp | Gly |      |  |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |      |  |
| aaa | act | gga | gct | aca | ggg | acg | aag | aaa | aca | atg | gag | ggt | gat | gct | gtc | 624  |  |
| Lys | Thr | Gly | Ala | Thr | Gly | Thr | Lys | Lys | Thr | Met | Glu | Val | Asp | Ala | Val |      |  |
|     | 195 |     |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |      |  |
| att | gga | gct | gat | gga | gct | aac | tct | agg | ggt | gct | aaa | tct | att | gat | gct | 672  |  |
| Ile | Gly | Ala | Asp | Gly | Ala | Asn | Ser | Arg | Val | Ala | Lys | Ser | Ile | Asp | Ala |      |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |      |  |
| ggg | gat | tac | gac | tac | gca | att | gca | ttt | cag | gag | agg | att | agg | att | cct | 720  |  |
| Gly | Asp | Tyr | Asp | Tyr | Ala | Ile | Ala | Phe | Gln | Glu | Arg | Ile | Arg | Ile | Pro |      |  |
| 225 |     |     |     |     | 230 |     |     |     | 235 |     |     |     |     |     | 240 |      |  |
| gat | gag | aaa | atg | act | tac | tat | gag | gat | tta | gct | gag | atg | tat | ggt | gga | 768  |  |
| Asp | Glu | Lys | Met | Thr | Tyr | Tyr | Glu | Asp | Leu | Ala | Glu | Met | Tyr | Val | Gly |      |  |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |      |  |
| gat | gat | gtg | tgc | ccg | gat | ttc | tat | ggg | tgg | gtg | ttc | cct | aag | tgc | gac | 816  |  |
| Asp | Asp | Val | Ser | Pro | Asp | Phe | Tyr | Gly | Trp | Val | Phe | Pro | Lys | Cys | Asp |      |  |
|     |     | 260 |     |     |     |     |     | 265 |     |     |     |     | 270 |     |     |      |  |
| cat | gta | gct | ggt | gga | aca | ggg | act | gtg | act | cac | aaa | ggg | gac | atc | aag | 864  |  |
| His | Val | Ala | Val | Gly | Thr | Gly | Thr | Val | Thr | His | Lys | Gly | Asp | Ile | Lys |      |  |
|     | 275 |     |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |      |  |
| aag | ttc | cag | ctc | gcg | acc | aga | aac | aga | gct | aag | gac | aag | att | ctt | gga | 912  |  |
| Lys | Phe | Gln | Leu | Ala | Thr | Arg | Asn | Arg | Ala | Lys | Asp | Lys | Ile | Leu | Gly |      |  |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |      |  |
| ggg | aag | atc | atc | cgt | gtg | gag | gct | cat | ccg | att | cct | gaa | cat | ccg | aga | 960  |  |
| Gly | Lys | Ile | Ile | Arg | Val | Glu | Ala | His | Pro | Ile | Pro | Glu | His | Pro | Arg |      |  |
| 305 |     |     |     |     | 310 |     |     |     | 315 |     |     |     |     |     | 320 |      |  |
| cca | cgt | agg | ctc | tgc | aaa | cgt | gtg | gct | ctt | gta | ggg | gat | gct | gca | ggg | 1008 |  |
| Pro | Arg | Arg | Leu | Ser | Lys | Arg | Val | Ala | Leu | Val | Gly | Asp | Ala | Ala | Gly |      |  |
|     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |      |  |
| tat | gtg | act | aaa | tgc | tct | ggg | gaa | ggg | atc | tac | ttt | gct | gct | aag | agt | 1056 |  |
| Tyr | Val | Thr | Lys | Cys | Ser | Gly | Glu | Gly | Ile | Tyr | Phe | Ala | Ala | Lys | Ser |      |  |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |      |  |



gga aga atg tgt gct gaa gcc att gtc gaa ggt tca cag aat ggt aag 1104  
 Gly Arg Met Cys Ala Glu Ala Ile Val Glu Gly Ser Gln Asn Gly Lys  
 355 360 365  
  
 aag atg att gac gaa ggg gac ttg agg aag tac ttg gag aaa tgg gat 1152  
 Lys Met Ile Asp Glu Gly Asp Leu Arg Lys Tyr Leu Glu Lys Trp Asp  
 370 375 380  
  
 aag aca tac ttg cct acc tac agg gta ctt gat gtg ttg cag aaa gtg 1200  
 Lys Thr Tyr Leu Pro Thr Tyr Arg Val Leu Asp Val Leu Gln Lys Val  
 385 390 395 400  
  
 ttt tac aga tca aat ccg gct aga gaa gcg ttt gtg gag atg tgt aat 1248  
 Phe Tyr Arg Ser Asn Pro Ala Arg Glu Ala Phe Val Glu Met Cys Asn  
 405 410 415  
  
 gat gag tat gtt cag aag atg aca ttc gat agc tat ctg tac aag cgg 1296  
 Asp Glu Tyr Val Gln Lys Met Thr Phe Asp Ser Tyr Leu Tyr Lys Arg  
 420 425 430  
  
 gtt gcg ccg ggt agt cct ttg gag gat atc aag ttg gct gtg aac acc 1344  
 Val Ala Pro Gly Ser Pro Leu Glu Asp Ile Lys Leu Ala Val Asn Thr  
 435 440 445  
  
 att gga agt ttg gtt agg gct aat gct cta agg aga gag att gag aag 1392  
 Ile Gly Ser Leu Val Arg Ala Asn Ala Leu Arg Arg Glu Ile Glu Lys  
 450 455 460  
  
 ctt agt gtt taagaaacaa ataatgaggt ctatctcctt tcttcatctc 1441  
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&lt;211&gt; 467

&lt;212&gt; PRT

<213> *Arabidopsis thaliana*

&lt;400&gt; 8

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 Leu Pro Gln Arg Arg Thr Ser Leu Arg Val Thr Ala Ala Arg Ala Thr  
 35 40 45  
  
 Pro Lys Leu Ser Asn Arg Lys Leu Arg Val Ala Val Ile Gly Gly Gly  
 50 55 60  
  
 Pro Ala Gly Gly Ala Ala Ala Glu Thr Leu Ala Gln Gly Gly Ile Glu  
 65 70 75 80  
  
 Thr Ile Leu Ile Glu Arg Lys Met Asp Asn Cys Lys Pro Cys Gly Gly

| 85  |     |     |     |     |     |     |     |     |     | 90  |     |     |     |     | 95  |  |  |  |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|--|--|
| Ala | Ile | Pro | Leu | Cys | Met | Val | Gly | Glu | Phe | Asn | Leu | Pro | Leu | Asp | Ile |  |  |  |  |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |  |  |  |  |
| Ile | Asp | Arg | Arg | Val | Thr | Lys | Met | Lys | Met | Ile | Ser | Pro | Ser | Asn | Ile |  |  |  |  |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |  |  |  |  |
| Ala | Val | Asp | Ile | Gly | Arg | Thr | Leu | Lys | Glu | His | Glu | Tyr | Ile | Gly | Met |  |  |  |  |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |  |  |  |
| Val | Arg | Arg | Glu | Val | Leu | Asp | Ala | Tyr | Leu | Arg | Glu | Arg | Ala | Glu | Lys |  |  |  |  |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |  |  |  |
| Ser | Gly | Ala | Thr | Val | Ile | Asn | Gly | Leu | Phe | Leu | Lys | Met | Asp | His | Pro |  |  |  |  |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |  |  |  |  |
| Glu | Asn | Trp | Asp | Ser | Pro | Tyr | Thr | Leu | His | Tyr | Thr | Glu | Tyr | Asp | Gly |  |  |  |  |
|     |     | 180 |     |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |  |  |  |
| Lys | Thr | Gly | Ala | Thr | Gly | Thr | Lys | Lys | Thr | Met | Glu | Val | Asp | Ala | Val |  |  |  |  |
|     | 195 |     |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |  |  |  |
| Ile | Gly | Ala | Asp | Gly | Ala | Asn | Ser | Arg | Val | Ala | Lys | Ser | Ile | Asp | Ala |  |  |  |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |  |  |  |
| Gly | Asp | Tyr | Asp | Tyr | Ala | Ile | Ala | Phe | Gln | Glu | Arg | Ile | Arg | Ile | Pro |  |  |  |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |  |  |  |
| Asp | Glu | Lys | Met | Thr | Tyr | Tyr | Glu | Asp | Leu | Ala | Glu | Met | Tyr | Val | Gly |  |  |  |  |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |  |  |  |  |
| Asp | Asp | Val | Ser | Pro | Asp | Phe | Tyr | Gly | Trp | Val | Phe | Pro | Lys | Cys | Asp |  |  |  |  |
|     |     | 260 |     |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |  |  |  |
| His | Val | Ala | Val | Gly | Thr | Gly | Thr | Val | Thr | His | Lys | Gly | Asp | Ile | Lys |  |  |  |  |
|     | 275 |     |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |  |  |  |
| Lys | Phe | Gln | Leu | Ala | Thr | Arg | Asn | Arg | Ala | Lys | Asp | Lys | Ile | Leu | Gly |  |  |  |  |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |  |  |  |  |
| Gly | Lys | Ile | Ile | Arg | Val | Glu | Ala | His | Pro | Ile | Pro | Glu | His | Pro | Arg |  |  |  |  |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |  |  |  |  |
| Pro | Arg | Arg | Leu | Ser | Lys | Arg | Val | Ala | Leu | Val | Gly | Asp | Ala | Ala | Gly |  |  |  |  |
|     |     |     | 325 |     |     |     |     |     | 330 |     |     |     |     | 335 |     |  |  |  |  |
| Tyr | Val | Thr | Lys | Cys | Ser | Gly | Glu | Gly | Ile | Tyr | Phe | Ala | Ala | Lys | Ser |  |  |  |  |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |  |  |  |  |
| Gly | Arg | Met | Cys | Ala | Glu | Ala | Ile | Val | Glu | Gly | Ser | Gln | Asn | Gly | Lys |  |  |  |  |
|     | 355 |     |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |  |  |  |  |
| Lys | Met | Ile | Asp | Glu | Gly | Asp | Leu | Arg | Lys | Tyr | Leu | Glu | Lys | Trp | Asp |  |  |  |  |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |  |  |  |  |
| Lys | Thr | Tyr | Leu | Pro | Thr | Tyr | Arg | Val | Leu | Asp | Val | Leu | Gln | Lys | Val |  |  |  |  |
| 385 |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     |     | 400 |  |  |  |  |

Phe Tyr Arg Ser Asn Pro Ala Arg Glu Ala Phe Val Glu Met Cys Asn  
                                     405                                    410                                    415

Asp Glu Tyr Val Gln Lys Met Thr Phe Asp Ser Tyr Leu Tyr Lys Arg  
                                     420                                    425                                    430

Val Ala Pro Gly Ser Pro Leu Glu Asp Ile Lys Leu Ala Val Asn Thr  
                                     435                                    440                                    445

Ile Gly Ser Leu Val Arg Ala Asn Ala Leu Arg Arg Glu Ile Glu Lys  
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Leu Ser Val  
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